Engine and Turbine Testing Guidance

This policy applies to units which are regulated by the State. It does not apply to units for which Federal requirements are applicable.

Initial Compliance Test

Applicability:

Engines and turbines which meet both of the following conditions are required by the State to conduct an initial compliance test for NO_x, O_2 and CO:

1. The maximum rated power is greater than 500 horsepower.
2. It is anticipated that the engine or turbine will operate more than 720 hours in a semiannual period.

If it was not anticipated that an engine or turbine would operate more than 720 hours in a semiannual period, but the engine or turbine does operate more than 720 hours in a semiannual period, the facility shall make a concerted effort to perform the initial compliance test as expeditiously as possible. Initial compliance tests are also required after a major engine overhaul.

Purpose:

The purpose of the initial test is to demonstrate compliance with the permit limits, and to re-establish permit limits if necessary.

Method:

A thirty day advance notification and testing protocol is required to be submitted to the Air Quality Assessment Division's Engineering Support Group. A pretest meeting may be requested, if deemed necessary. Two copies of the test results, calibration procedures, and operating conditions during the test are required to be submitted within 60 days of performing the test, unless a different frequency is specified by the facility's air permit.

EPA Methods 1-4, 7E and 10 from 40 CFR 60 Appendix A shall be used.

Three test runs at maximum load will be conducted for each unit. Testing may be done at a lower load, but retesting will be required in order to operate at a higher load. Load is determined by effective horsepower, which is calculated using the Gas Processor's Association (GPA) formula or other calculation as approved by the Air Quality Assessment Division's Engineering Support Group.

For engines, each run must last at least one hour. For turbines, each run must last at least twenty minutes.

The following operating conditions must be recorded every fifteen minutes and included in the test report: engine speed, fuel rate, effective horsepower, intake manifold temperature,

suction pressure, discharge pressure, fuel header pressure, spark ignition time, stack temperature, ambient temperature, and compressed gas throughput.

In cases where there are several engines or turbines of the exact make and model at a facility, a representative subset may be tested in lieu of testing all identical engines. A representative subset must contain at least 50% of the affected units.

Alternatives:

Alternate methods must have comparable accuracy and reliability to the EPA methods listed above. Use of an alternate method must be approved by the Air Quality Assessment Division's Engineering Support Group. Examples of alternate methods include:

1. Use of a portable analyzer in lieu of a reference method analyzer to measure concentration. The analyzer model must be approved. Calibrations must be done using EPA Protocol 1 gases according to the procedures for drift and bias limits outlined in EPA Method 7E and/or Method 10. Analyzer data shall be recorded at least once every 5 minutes. Portable emission analyzers that have received approval from the Department for internal combustion engine testing include:
    A. Enerac 700, 2000, 3000 and 3000E
    B. Dean DAI 6000 and 6500
    C. Ecom-kl, Ecom A-Plus, and Ecom AC
    D. Testo 350
    E. Lancom III
2. Use of F-factors to calculate flow rate through the stack. The F-factor method is described in EPA Method 19. The fuel flow rate is measured using a dedicated fuel meter. The fuel meter data should be included in the report, along with the calculations.
3. If a dedicated fuel meter is not available, manufacturer's data may be used to estimate stack flow rate. The manufacturer's data should be included in the test report, along with the calculations. The flow rate should be based on the operating conditions at the time of the test.

Overhauls:

An initial test is also required after a major engine overhaul. "Major engine overhaul" means that the entire combustion section of the engine is dismantled, parts are replaced/reconditioned as needed, and the engine is restarted. Any of the following may also constitute a major engine overhaul: the disassembly of cylinder heads; removal of intake and exhaust valve assemblies; removal of power piston bodies, pins, and connecting rods; disconnecting intake and exhaust manifolds; and disassembly of the fuel aspiration system such as carburetors and/or turbo chargers.

Semiannual Test

Applicability:

Following completion of the initial compliance test, engines which meet both of the following conditions are required by the State to conduct compliance tests for NO_x, O_2 and CO semiannually:

1. The maximum rated power is greater than 500 horsepower.
2. The engine operates more than 720 hours in a semiannual period.

A semiannual test is not required for an engine which does not operate for more than 720 hours during a semiannual period. If an engine is normally subject to semiannual testing, the engine is not required to perform a semiannual test for any semiannual period during which the engine operates for less than 720 hours. Units equipped with catalytic converters are required to perform testing annually instead of semiannually.

In lieu of semiannual testing, parametric monitoring or preventative maintenance may be performed, if allowed by the permit. For engines on which the semiannual preventative maintenance analysis is performed in lieu of testing, the semiannual preventative maintenance analysis is not required for any semiannual period during which the engine operates for less than 720 hours.

Purpose:

The purpose of the semiannual test is to demonstrate that the emissions are maintained in the same range as during the initial stack test and that the emissions are below permitted levels.

Timeframe:

Semiannual testing shall be performed within the following timeframes, as applicable:

1. Between five to seven months after the initial compliance test.
2. Between five to seven months of the previous semiannual test.
3. Within one month of operating for more than 720 hours for the semiannual period, if a semiannual test was not required in the previous semiannual period.

Method:

Pretest meetings are not required for semiannual tests. Advance notification of the test date and observation by DEQ is not required. The test results, calibration procedures, and operating conditions during the test are not required to be submitted to DEQ but shall be kept on site at a location accessible to the DEQ inspector.

The model of portable analyzer must be approved by the Air Quality Assessment Division's Engineering Support Group. Before the test, the analyzer must be calibrated. Alternatively, the calibration of the CO, NO, and NO_2 analyzers may be checked by performing an analyzer calibration error test with EPA Protocol 1 gas. CO, NO, and NO_2 analyzers shall be calibrated with less than 2% calibration error using the three gas concentrations defined in 40

CFR 60 Appendix A, Method 7E Sec 7.1. O_2 analyzers may be calibrated (or checked) at 0 and 20.9%. Calibrations may be done off-site. If any analyzer drifts more than that allowed by the applicable method, the test must be repeated. Alternate calibration procedures must be approved in advance by the Air Quality Assessment Division's Engineering Support Group.

Three test runs shall be conducted for each unit. Each run must last at least twenty minutes. Analyzer data must be recorded at least every five minutes. The engine's effective horsepower must be recorded during each run of the test. If the engine is running at the same load as during the initial compliance test, the flow rate out of the stack can be assumed to be the same as during the initial compliance test and need not be measured. If the engine is running at a load which is more than 10% higher or lower than during the initial compliance test, the flow rate shall be measured or estimated during the semiannual test.

In cases where there are several engines of the exact make and model at a facility, all engines must be tested during the semiannual test.

Annual Test

Applicability:

Following completion of the initial compliance test, engines equipped with catalytic converters which meet both of the following conditions are required by the State to conduct compliance tests for NO_x, O_2 and CO annually:

1. The maximum rated power is greater than 500 horsepower.
2. The engine operates more than 720 hours in a semiannual period.

An annual test is not required for an engine which does not operate for more than 720 hours during either semiannual period. If an engine is normally subject to annual testing, the engine is not required to perform an annual test for any annual period during which the engine operates for less than 720 hours during both semiannual periods.

Purpose:

The purpose of the annual test is to demonstrate that the emissions are maintained in the same range as during the initial stack test and that the emissions are below permitted levels.

Timeframe:

Annual testing shall be performed within the following timeframes, as applicable:

1. Between eleven and thirteen months after the initial compliance test.
2. Between eleven and thirteen months of the previous annual test.
3. Within one month of operating for more than 720 hours for a semiannual period, if an annual test was not required previously.

Method:

The method for the annual test is the same as the method for the semiannual test above.